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Growing plants with salty water

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GROWING PLANTS WITH SALTY WATER

LACK of good quality water in many parts of Western Australia often forces people to use salty water for irrigation and gardening.

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This article gives some hints on how to reduce salt damage to plants when salty water must be used for irrigation or gardening.

It includes a table of plants which may be irrigated with water of varying degrees of salinity and lists precautions which should be taken for each group.

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The saltier the water, the worse will be the effects on plants. However, the effects of salty water on plants depend also on soil type, species of plant and watering technique. This article discusses some of the ways of reducing salt damage to plants, and suggests suitable plants for waters of various salinities.

Salty or brackish waters

The term "brackish" is used to describe water containing excessive salt. In most ground waters from the agricultural areas of Western Australia common salt (sodium chloride) accounts for about 75 per cent. of the total salts present. Magnesium salts have little significance in waters of the agricultural areas. However, in some coastal and pastoral areas, the proportion of common salt may be considerably greater or less than 75 per cent.

Taste is an unreliable guide to the quality of water. If the quality is doubtful, it is a good idea to have the water analysed for salt content.

In the past, the Department of Agriculture and the Government Chemical Laboratories have expressed the salt content of waters as grains per gallon. With the introduction of the metric system, this will in future be expressed as *milligrams per litre (mg/l)*. For waters suitable for agriculture, milligrams per litre is virtually the same as *parts per million (ppm)*, another common expression. In some countries the salt content of water is expressed in terms of the *electrical conductivity (EC)* of the water.

In the accompanying table salt levels are expressed as mg/l, but values for EC and grains per gallon (gpg) are included for comparison.

How salt affects plants

Competition for water

Salt competes with plants for water. The more salt present in the soil the

harder it becomes for plants to extract water from the soil. When the competition becomes too great the plants begin to "burn off" as they would with an ordinary shortage of water.

Toxic effects

Plants absorb salts from the soil in an attempt to increase their power to extract water. Some plants do not control their uptake of salts well and absorb harmful amounts which kill the plant tissues. Also some dissolved salts are more harmful than others.

Seedlings of most species are more sensitive to excess salt than mature plants. Very salty water can sometimes be used on mature plants near harvest without damage.

Symptoms of salt damage

The first effect of salts on plants is to reduce growth, maturity is usually advanced, and plants sometimes turn deep blue-green.

Leaves are scorched or burnt around the edges, and may wither and die. The leaves may drop off and shoots may die back or re-shoot. The general appearance resembles that of severe drought injury.

If the salts are absorbed from the soil, the whole plant is affected and the oldest leaves show the first symptoms. However damage caused by salty water touching the leaves is restricted to those leaves on which water or spray drift falls.

Minimise damage

Five fundamental principles should be observed when watering with salty water.

Water in large doses

Occasional heavy applications are better than frequent light applications of water. A heavy application leaches (or washes) the accumulated salts down below the root zone.

With light applications, much of the water is evaporated, leaving the salts in the top few inches of soil. Plants also remove mainly water and leave salts behind in the soil. The water applied should be enough to replace that lost in evaporation, replace that used by the plant, and leach any accumulated salts below the main root zone.

Provide good drainage

For effective leaching of salts out of the root zone, good drainage is essential. Sandy soils are usually fairly well drained, but leaching is much more difficult on fine-textured (clayey) soils because water will not pass through them quickly.

The use of tile, mole or other drains is sometimes necessary to keep water tables down and lead drainage water away. In some situations it may be helpful to raise garden beds above the ground.

Control evaporation

Evaporation can be reduced by keeping a mulch of organic material such as animal manure, garden refuse or sawdust on the soil surface. Reduced evaporation reduces salt left behind in the soil after evaporation. The mulch also helps water penetration by keeping the surface open and receptive to water. Enough water must be applied to wet both the mulch and the soil, and allow for some leaching.

Keep water off plants

Good quality water can be applied to the leaves of most plants without fear of damage. Some plants such as hydrangeas and dahlias may be damaged even by good waters, especially if they have wilted.

As waters become more salty, the likelihood of damage increases, so with poor waters it is important to keep the water off the leaves. If this is not possible, injury can be kept to a minimum with careful watering.

- Avoid watering in the heat of the day. In hot weather water landing on the leaves evaporates leaving salts behind. If the salts enter the leaves, the plants may be damaged.
- At night evaporation is much less, and less salt enters the leaves, so damage from poor quality water is lessened if it is used at night.
- Avoid using sprinklers which give fine droplets. Fine spray will drift further and evaporate quicker than coarse spray. Salts will not be washed off the leaves, and may cause severe leaf burn.
- Avoid sprinklers which give intermittent wetting.

PLANTS AND SALT WATER IRRIGATION

- Plants are arranged in approximate order of salt tolerance in each column with the least tolerant at the top.
- The difference between two or three plants near one another in each column is small and possibly not significant.
- The plant and water groupings are not rigid, merely a general guide. Soil texture and drainage could be over-riding factors.
- Plants listed as suitable for salty waters will nevertheless grow better with less salty water.

Water Group	Precautions for Irrigation Use (*See Important Footnote)	Suggested Plants				
		Pastures and Fodders	Fruit	Vegetables	Ornamentals	
A **0-500 mg/l‡** (0–35 gpg‡ or 0–800 EC‡)	1. Avoid wetting leaves on hot dry days	Ladino clover Red clover Alsike clover White Dutch clover Subterranean clover	Persimmon Loquat Passionfruit Strawberry Avocado Almond Apricot Peach Plum Lemon Grapefruit Orange Grape	Parsnips Green beans Celery Radish Cucumber Squash Peas Onion Carrot Potatoes Sweet Corn Lettuce	African violet Primula Gardenia Begonia Azalia Camelia Magnolia Fuchsia	
B **500-1,500 mg/l** (35–105 gpg or 800–2,300 EC)	1. Avoid wetting leaves during daytime 2. Avoid light frequent waterings 3. Water quickly and use continuous-wetting sprinklers if wetting the leaves	Cocksfoot Perennial ryegrass	Mulberry Apple Pear	Caulifiower Bell pepper Cabbage Broccoli Tomato	Geranium Gladiolus Bauhinia Zinnia Rose Aster Poinsettia Musa Podocarpus	
C **1,500-3,500 mg/l** (105–245 gpg or 2,300–5,500 EC)	1. Avoid wetting leaves of most plants where possible 2. Adequate leaching necessary	Oats (hay) Wheat (hay) Rye (hay) Lucerne Sudan grass Paspalum dilatatum Strawberry clover Sweet clovers Millet Wimmera ryegrass Rhodes grass Couch grass Barley Birdsfoot trefoil	Olive Fig Pomegranate	Spinach Asparagus Kale Garden beets	Stock Chrysanthemum Carnation Hibiscus Oleander Bougainvillea Vinca Aus. Hop Bush (*Dodonea attenuata*) Coprosma (green and variegated) Japanese Pepper (*Schinus terbinthifolius*) *Ficus* spp. in general *Ficus hillii* False acacia (*Robinia pseudoacacia*) Queensland Pyramid Tree (*Lagunaria patersonii*) N.Z. Christmas bush (*Metrosideros tomentosa*)	False mahogany (*Eucalyptus botryoides*) Rottnest ti-tree (*Melaleuca pubescens*) *C. cuppressiformis* Rottnest cyprus (*Callitris robusta*) *Acacia longifolia* Buffalo grass Kikuyu grass Portulaca Mesembryanthemum Boobyalla (*Myoporum acuminatum*) Morrel (*E. oleosa*) Swamp yate (*E. occidentalis*) York gum (*E. loxophloeba*) Couch grass Bamboo Kondinin blackbutt (*E. Kondininensis*) Native pine (*Actinostrobus pyramidalis*)
D **3,500-13,000 mg/l** (245–910 gpg or 5,500–20,300 EC)	1. Do not wet leaves where possible 2. Excellent drainage and leaching essential	Seashore paspalum (*Paspalum vaginatum*) *Puccinella ciliata* Salt water couch (*Sporobolus virginicus*)	Date palm		Canary Palm (*Phoenix canariensis*) *Paspalum vaginatum* (lawns) Salt sheoaks (*Casuarina cristata*) Salt sheoaks (*Casuarina glauca*) Salt river gum (*Eucaluptus sargentii*) Tamarisks (evergreen and deciduous) Saltbushes	
E **More than 13,000 mg/l** (910 gpg or 20,300 EC)	Too salty for irrigation					

* Under average conditions the precautions listed should enable satisfactory growth of the suggested plants. Yield of virtually all plants would be progressively reduced as saltier waters are used.

‡ All figures are for total soluble salts ; mg/l = milligrams per litre ; gpg = grains per gallon ; EC = electrical conductivity in micromhos per centimetre at 25° C.

Sprinklers of the "knocker" type rotate slowly, so the leaf is wet for a few seconds, and then is left until the next rotation. This gives time for the water on the leaves to evaporate before the next rotation, leaving salts behind. If these enter the leaves, they may cause severe leaf burn.

With poor water the aim should be to apply the necessary water as quickly as possible to reduce the time that the leaves are wet. It may be helpful with movable sprinkler lines to run the lines along the wind direction. Cross-wind sprinkler lines should be moved in the direction of the spray drift to wash the leaves.

With very good water, sprinkler type is not important.

Use salt tolerant plants

Some plants are naturally suited to growing in salty situations, while others are adapted to a salt-free environment. Tamarisk trees and "pig-face" plants are examples of those able to survive with salty water. Peas, beans and roses, on the other hand, are easily damaged by salty water.

If only poor quality water is available, appropriate plants should be selected. Lists have been prepared for Western Australia showing the ability of various plants to withstand salty waters. These are printed in the Table accompanying this article.

It should be noted that—

Plants are arranged in approximate order of salt tolerance in each column with the least tolerant at the top.

The difference between two or three plants near one another in each column is small and possibly not significant.

The plant and water groupings are not rigid, merely a general guide. Soil texture and drainge could be overriding factors.

Plants listed as suitable for salty waters will nevertheless grow better with less salty water.

Water salinity groupings

The grouping of water salinities conforms fairly closely to standards used elsewhere.

GROUP A.—0 to 500 milligrams per litre (0-35 grains per gallon) total soluble salts.

Waters of Group A are suitable for irrigating all plants. It is still possible to cause some salt damage if plants are watered carelessly. For example, fine misty sprays used in hot weather can drift on to the leaves and evaporate, leaving excess salt behind to be absorbed by the leaves and burn them.

GROUP B.—500 to 1,500 milligrams per litre (35-105 grains per gallon) total soluble salts.

Group B waters are suitable for irrigating most plants provided care is taken. Sprinklers used should give continuous wetting, and watering should preferably be done at night.

GROUP C.—1,500 to 3,500 milligrams per litre (105-245 grains per gallon) total soluble salts.

Plants of moderate salt tolerance may be irrigated with Group C waters. If possible, sprinklers should not be used for irrigation, as damage may occur. (Obvious exceptions are lawns and pastures). Good drainage is essential, and each watering should be heavy enough to leach salts out of the root zone.

GROUP D.—3,500 to 13,000 milligrams per litre (245-910 grains per gallon) total soluble salts.

Group D waters are too salty for general irrigation. Only some very salt tolerant plants can be watered without damage. Drainage and leaching must be excellent to avoid salt accumulation, and the water must never be allowed to contact plant leaves. (Obvious exceptions are lawns and pastures). Waters in this group can sometimes be used to carry mature plants through to harvest.

The Table gives some guide to suitable plants for each water group.

Other problems

Saline irrigation water may change the chemistry of the soil, resulting in poor structure, low permeability and reduced plant growth. Such problems are most common where the soils are fine textured (clayey) and where irrigation is the main source of water for crops. These problems are not common in the agricultural areas of W.A.